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# USE OF 5F BIPOLAR ELECTROSURGICAL PROBE IN ENDOSCOPIC UROLOGICAL PROCEDURES

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## ABSTRACT

Experimental data have shown bipolar electrodes to function in saline solution with less volume and depth of tissue destruction compared to similar sized monopolar electrodes. We applied the same bipolar generator and electrodes used in laboratory testing in 41 procedures on 36 patients to determine if the bipolar electrode will provide clinically adequate hemostasis. The bipolar electrode was used for bladder fulguration in 37 procedures and ureteral fulguration in 4. The procedures were performed by 7 urological surgeons and in normal saline solution. The bipolar electrode was believed to perform as well as the standard monopolar probe in 39 procedures. The 2 failures included 1 bladder tumor fulguration and 1 electroincision of a ureterointestinal anastomotic stricture. There were no episodes of recurrent bleeding after any procedure. The bipolar system has the added advantage of not requiring a return electrode (ground pad), thereby eliminating the possibility of skin burns. (*J. Urol., 143: 275–277, 1990*)

The introduction of electrosurgical techniques and instruments has had a dramatic impact on the practice of surgery. Urologists were among the first to apply this technology to endoscopic procedures.[1] To date many routine therapeutic endoscopic procedures of the urethra, prostate and bladder are performed with electrosurgery. In other disciplines endoscopists have gravitated toward the use of bipolar rather than monopolar electrosurgical systems.[2, 3] Urologists have adhered to the use of the monopolar system partly because endoscopic urological procedures are performed in a fluid rather than air-filled cavity as in gastrointestinal or gynecological procedures. Technological advances have permitted the development of a bipolar electrode that can be passed easily through most endoscopic instruments. Recent animal studies have shown the bipolar electrode to be effective in normal saline solution and at a lower power output than similar sized monopolar electrodes.[4, 5] Moreover, histological examination of experimental animal bladders and ureters showed a decreased depth of tissue penetration with the bipolar electrode.[5, 6] These features of the bipolar electrosurgical system, as well as the elimination of the return electrode (ground pad) with the possibility of electrode burn, make the use of this system attractive. The remaining question to be answered is whether the bipolar electrode would be practical and provide adequate hemostasis in the clinical setting. We present our experience with the clinical application of the bipolar electrode for the fulguration of bladder and ureteral lesions.

## MATERIALS AND METHODS

The 5F bipolar ACMI BICAP system was used for fulguration in 41 procedures on 36 patients who presented between June 1988 and February 1989 for endoscopic electrosurgical therapy. During this interval 5 patients returned for repeat procedures. The 20 men and 16 women were 37 to 88 years old (average age 64 years). Of the procedures 37 were in the bladder and 4 in the ureter. The bladder procedures involved cystoscopy either through the rigid (28) or flexible (9) cystoscope with biopsy and/or fulguration of bladder lesions. Indications for cystoscopy most commonly were hematuria or followup of a previously resected bladder tumor. All flexible cystoscopic studies were performed on men. All biopsies were done with a cold-cup device and ranged from 1 to 5, with some procedures involving biopsy and fulguration of small bladder tumors. All procedures were done on an outpatient basis, most (35) in a freestanding surgical center setting. One patient had general anesthesia, while the remainder had 2% lidocaine jelly per urethram (6 procedures) or a combination of lidocaine with intravenous midazolam hydrochloride (28). The average dose of midazolam hydrochloride was 2.5 mg. (range 0.5 to 6.0 mg.) given in divided doses starting before passage of the cystoscope. In 5 patients cystoscopy was repeated at 3 months. The bladder biopsy results were transitional cell carcinoma in 20 patients, adenocarcinoma in 1, an inflammatory process in 10, dysplasia in 4 and inverted papilloma in 2. All 5 patients who underwent repeat cystoscopy and biopsy had transitional cell carcinoma initially and 3 had recurrence at 3 months.

There were 4 ureteral procedures in which the bipolar electrode was applied in the ureter: 3 rigid ureteroscopy studies and 1 incision of ureterointestinal anastomotic stricture through a flexible nephroscope. In all ureteroscopic cases biopsies of the ureter showed either transitional cell carcinoma (1 patient) or ureteritis (2). All procedures were performed with the patient under general anesthesia and all of these patients required at least 1 day of postoperative hospitalization.

All procedures were performed in normal saline solution through standard urological endoscopic instruments. The procedures were performed by 7 board certified urologists who were asked to use this electrode as they would its monopolar counterpart. Previously, all urologists routinely had used the monopolar electrode system for fulguration in the bladder and ureter. The nurse assisting the surgeon was instructed in the proper handling of the electrode and generator before the procedures. The BICAP generator was set for continuous current application at a medium range of 5.

The bipolar tip of the 5F probe consists of a 6 mm. long ceramic shaft with a rounded end and 4 metallic strips 1 mm. wide equally spaced around the shaft. Two opposing strips are attached together across the crown of the tip to form a single electrode. The remaining 2 strips are attached internally in the catheter and constitute the remaining half of the bipolar electrode (see figure). The electrode has a uniform diameter for its entire 190 cm. length.

Each electrode was used for multiple procedures until it failed to function adequately. A total of 4 electrodes was used for the 41 procedures. The electrodes were sterilized preoperatively with the endoscopic equipment by 10-minute submersion in standard 2% glutaraldehyde solution. After the procedures the

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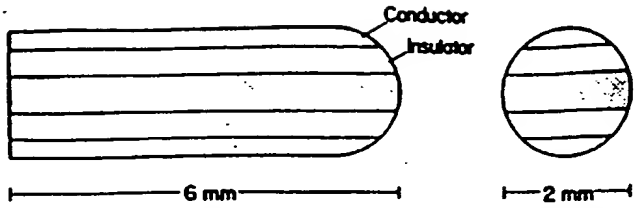


Longitudinal and horizontal views of tip of bipolar electrode show strips of conducting metal separated by insulator.

operating urologist was asked to compare the bipolar probe with the standard monopolar electrode. Patients were questioned about the level of discomfort, and the assisting nurse was asked to assess the pain as well as the ease of handling the bipolar electrode system. All patients were followed for a minimum of 2 months.

## RESULTS

The bipolar electrode provided adequate hemostasis in all but 1 endoscopic procedure. In that cystoscopic procedure for biopsy and fulguration of a grade 3 transitional cell carcinoma the bipolar electrode did not provide adequate hemostasis and a monopolar ball electrode was used. The surgeon believed that neither probe adequately controlled the bleeding but with bed rest and hydration the hematuria resolved during the next 24 hours. The patient underwent repeat biopsy by the same surgeon 3 months later during which the bipolar electrode provided successful hemostasis. All cystoscopic biopsies were performed as outpatient procedures with patients discharged from the hospital without a Foley catheter. No immediate or delayed bleeding was noted during the next 2 months. There were no clinically apparent bladder perforations. None of the cystoscopic procedures with the patient under local or assisted local anesthesia required premature termination due to patient discomfort. The 6 procedures without intravenous sedation were performed on 5 patients who reported a pinching sensation during electrode activation similar to that experienced during the cold-cup biopsy. All 5 patients tolerated the procedure well with 1 undergoing a repeat procedure under the same circumstances.

In 4 patients the bipolar electrode was used in the ureter, while in 3 the probe was passed through the rigid ureteroscope and provided good hemostasis after biopsy. The bipolar electrode was used unsuccessfully to incise a ureteral anastomotic stricture. Although it passed easily through the flexible nephroscope the electrode did not incise but rather only charred the fibrous tissue. A monopolar electrode on the cut setting successfully incised the stricture.

The operating urologist reported satisfactory results with the bipolar electrode and believed its hemostasis to equal that of the monopolar electrode. Moreover, 6 of the 7 urologists have continued to use the bipolar system despite an equally available monopolar system.

Drawbacks to the system identified by the urologists include the fact that tissue, especially papillary bladder lesions, tends to adhere to the electrode tip and that the electrode end is not balled like many monopolar electrodes but cylindrical, requiring the use of the side rather than the tip of the electrode for application to the bladder. The 4 nurses who worked with the bipolar system during the study found that it took no more and probably less time to set up and use than the monopolar system. The 5 patients in whom previous bladder biopsies were fulgurated by monopolar electrodes were unable to make any consistent distinction in pain caused by electrode application.

## DISCUSSION

Experimental data have shown that bipolar electrodes will function in electrolyte solutions with less depth and volume of tissue damage, due partly to the lower power output of bipolar generators. We used the same bipolar generator and electrodes clinically to determine if the conclusions reached in the laboratory will apply in the clinical situation. Although the nature of clinical evaluation would not allow histological sectioning of burn sites or measurements of power output, our goal was to determine clinical application. Indeed, the bipolar electrode in the human bladder and ureter provided adequate hemostasis in all but 1 clinical situation and was believed to be equal to its monopolar counterpart in all phases, including setup and application. A total of 4 bipolar electrodes was required in the patients, which is more than one would expect to use with the monopolar electrodes. The reason for this finding is that the bipolar probes used were designed initially for use through a gastroscope and this increased length leads to easier bending with fracture of the internal wire bundles. Future bipolar electrodes designed for urological use will be somewhat shorter with a thickened shaft for the portion outside the endoscope, thus, decreasing the likelihood of wire bundle fracture.

If the 2 systems are roughly equal, why should the urologist consider changing systems? The advantages of the bipolar system are based on the current returning via the tip of the electrode rather than having to traverse the body to a ground pad. This feature permits application of the electrode in normal saline without the need for a ground pad. Eliminating the ground pad may aid in cost-containment as well as prevent ground pad burns. Although equipment prices vary greatly, in general the bipolar generator cost is about 10% greater than its monopolar counterpart. The use of the bipolar probe in saline solution has little clinical application in bladder biopsies, since extravasation rarely occurs but it may be of increased value when working in the ureter or renal pelvis. Likewise, the decreased depth of tissue penetration may be of benefit in thin-walled structures. The size and length of the electrode permit its use in most rigid and flexible urological endoscopes.

The drawbacks to the bipolar electrode are related to tissue adherence to the tip, especially when fulgurating papillary bladder cancers, but this also is encountered with monopolar electrodes. Although the tip of the bipolar electrode provides adequate surface area for application, it must be applied parallel rather than perpendicular to the tissue. This adaptation is made readily by the endoscopist within a short interval. The bipolar electrode system works at a much lower power output than the monopolar electrode (10 versus 60 watts)[5] and in this configuration the electrode cannot be used to incise tissue. Future technological advances may overcome this limitation and may allow for evolution of a bipolar loop capable of performing transurethral resections in normal saline solution.

The bipolar system has found application in other endoscopic specialties and in urological applications it parallels the monopolar system while offering increased safety by eliminating the possibility of ground pad burns. Research and technological advances may even further the application of bipolar diathermy to urology.

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